STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2020/2021

PTG0116 – TRIGONOMETRY AND COORDINATE GEOMETRY

(All sections / Groups)

XX OCTOBER 2020
2:30 pm – 4:30 pm
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 4 pages (excluding the cover page) with 4 questions and appendix.

2. Answer all **FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

a) The Faculty of Engineering of Multimedia University is located at 2°55’34” N, 101.641 ° E under the Global Positioning Coordinate. Convert

   i) 101.641 ° E into DMS format. [3 marks]

   ii) 2°55’34” N into decimal format. (accurate to 3 decimal place) [3 marks]

b) Given A = 12 cm, B = 8 cm and C = 10 cm. Solve the angle a, b and c. [9 marks]

c) Proof that

   i) $\sin 3A = 3\sin A - 4\sin^3 A$ [3 marks]

   ii) $\cos 3A = 4\cos^3 A - 3\cos A$ [3 marks]

   iii) $\cot 3\theta = \dfrac{\cot^3\theta - 3\cot\theta}{3\cot^2\theta - 1}$. [4 marks]

Question 2

a) A person is standing at the origin of the Cartesian coordinate system. He then moves to Cartesian coordinate (5, 12). Express his new position using the polar coordinate equivalent with reference to origin Cartesian coordinate system. [5 marks]

b) Given $\vec{A} = 2\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{B} = 5\hat{i} + 3\hat{j} + \hat{k}$. Find:

   i) $3\vec{A} + 2\vec{B}$ [2 marks]

   ii) $\vec{A} \bullet \vec{B}$ [2 marks]

   iii) $\vec{A} \times \vec{B}$ [6 marks]

c) Given $z_1 = 3 + i2$ and $z_2 = 4 - i3$. Find:

   i) $z_1 + z_2$ [2 marks]

   ii) $z_1 z_2$ [2 marks]

   iii) $\dfrac{z_1}{z_2}$ [6 marks]

   Express your answer in $a + ib$ format.

Continued …

Question 3

a) Show that $x^2 + y^2 + 2x + 4y - 4091 = 0$ is an equation for a circle. Determine its centre and radius. [5 marks]

b) $4x^2 + y^2 - 8x + 4y + 4 = 0$ is an equation for an ellipse. Determine

   i) its centre. [8 marks]

   ii) the major axis. [1 mark]

   iii) the foci. [5 marks]

c) Calculate the distance between A(1, 0, 5) and B(5, -1, 7) [3 marks]

d) Determine the midpoint of C(3, 11, -1) and D(7, 1, 4) [3 marks]

Question 4

Consider the following system of three linear equations.

$$\begin{aligned} x - y + z &= -4 \\ 2x - 3y + 4z &= -15 \\ 5x + y - 2z &= 12 \end{aligned}$$

a) Find the determinant, *D*. [5.5 marks]

b) Find the determinant, D_x, D_y and D_z. [3 × 5.5 marks]

c) Solve for x, y and z. [3 marks]

Continued …

Appendix
Formulae
Cofunction Identities

$\sin\theta = \cos(90^\circ - \theta)$

$\cos\theta = \sin(90^\circ - \theta)$

$\tan\theta = \cot(90^\circ - \theta)$

$\cos\theta = \sec(90^\circ - \theta)$

$\sec\theta = \operatorname{cosec}(90^\circ - \theta)$

$\cot\theta = \tan(90^\circ - \theta)$

$\cos(-\theta) = \cos(\theta)$

$\sin(-\theta) = -\sin(\theta)$

$\tan(-\theta) = -\tan(\theta)$

Sum and Difference Formulas

$\sin(A \pm B) = \sin A\cos B \pm \cos A\sin B$

$\cos(A \pm B) = \cos A\cos B \mp \sin A\sin B$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A\tan B}$$

$\sin(A+B) + \sin(A-B) = 2\sin A\sin B$

$\sin(A+B) - \sin(A-B) = 2\cos A\sin B$

$\cos(A+B) + \cos(A-B) = 2\cos A\cos B$

$\cos(A+B) - \cos(A-B) = -2\sin A\sin B$

Double Angle Formulas

$\sin 2A = 2\sin A\cos A$

$\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1 = 1 - 2\sin^2 A$

$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

Sum to Product

$$\sin A + \sin B = 2\sin\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

$$\sin A - \sin B = 2\cos\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)$$

$$\cos A + \cos B = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

$$\cos A - \cos B = -2\sin\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)$$

$$\vec{A} \bullet \vec{B} = |\vec{A}||\vec{B}|\cos\theta$$

$$\vec{A} \times \vec{B} = |\vec{A}||\vec{B}|\sin\theta\,\hat{a}_{AB}$$

Equations of a parabola: Vertex at (h,k); Axis of symmetry parallel to a coordinate axis; a>0

Vertex	Focus	Directrix	Equation	Description
(h,k)	$(h+a,k)$	$x=h-a$	$(y-k)^2=4a(x-h)$	Axis symmetry is parallel to the x-axis open right
(h,k)	$(h-a,k)$	$x=h+a$	$(y-k)^2=-4a(x-h)$	Axis symmetry is parallel to the x-axis open left
(h,k)	$(h,k+a)$	$y=k-a$	$(x-h)^2=4a(y-k)$	Axis symmetry is parallel to the y-axis open up
(h,k)	$(h,k-a)$	$y=k+a$	$(x-h)^2=-4a(y-k)$	Axis symmetry is parallel to the y-axis open down

Equations of a ellipse: Center at (h,k); Major axis parallel to a coordinate axis

Center	Major Axis	Foci	Vertices	Equation
(h,k)	Parallel to the x-axis	$(h+c,k)$ $(h-c,k)$	$(h+a,k)$ $(h-a,k)$	$\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$ a>b>0 and $b^2=a^2-c^2$
(h,k)	Parallel to the y-axis	$(h,k+c)$ $(h,k-c)$	$(h,k+a)$ $(h,k-a)$	$\frac{(x-h)^2}{b^2}+\frac{(y-k)^2}{a^2}=1$ a>b>0 and $b^2=a^2-c^2$

Equations of a hyperbola: Center at (h,k); Transverse axis parallel to a coordinate axis

Center	Transverse Axis	Foci	Vertices	Equation	Asymptotes
(h,k)	Parallel to the x-axis	$(h\pm c,k)$	$(h\pm a,k)$	$\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1$ $b^2=c^2-a^2$	$y-k=\pm\frac{b}{a}(x-h)$
(h,k)	Parallel to the y-axis	$(h,k\pm c)$	$(h,k\pm a)$	$\frac{(y-k)^2}{a^2}-\frac{(x-h)^2}{b^2}=1$ $b^2=c^2-a^2$	$y-k=\pm\frac{a}{b}(x-h)$

End of Appendix